Exercise 71

Use scientific (exponential) notation to express the following quantities in terms of the SI base units in Table 1.3:

(a) 0.13 g

(b) 232 Gg

(c) 5.23 pm

(d) 86.3 mg

(e) 37.6 cm

(f) 54 μm

(g) 1 Ts

(h) 27 ps

(i) 0.15 mK

Solution

The SI prefixes are listed in Table 1.3 on page 31. Write each number in scientific notation and use conversion factors to get the appropriate units.

(a) $$0.13\text{ g} = 1.3 \times 10^{-1}\ \cancel{\text{g}} \times \frac{1\text{ kg}}{1000\ \cancel{\text{g}}} = 1.3 \times 10^{-4}\text{ kg}$$

(b) $$232\text{ Gg} = 2.32 \times 10^{2}\ \cancel{\text{Gg}} \times \frac{10^{9}\ \cancel{\text{g}}}{1\ \cancel{\text{Gg}}} \times \frac{1\text{ kg}}{10^{3}\ \cancel{\text{g}}} = 2.32 \times 10^{8}\text{ kg}$$

(c) $$5.23\text{ pm} = 5.23\ \cancel{\text{pm}} \times \frac{1\text{ m}}{10^{12}\ \cancel{\text{pm}}} = 5.23 \times 10^{-12}\text{ m}$$

(d) $$86.3\text{ mg} = 8.63 \times 10^{1}\ \cancel{\text{mg}} \times \frac{1\ \cancel{\text{g}}}{1000\ \cancel{\text{mg}}} \times \frac{1\text{ kg}}{1000\ \cancel{\text{g}}} = 8.63 \times 10^{-5}\text{ kg}$$

(e) $$37.6\text{ cm} = 3.76 \times 10^{1}\ \cancel{\text{cm}} \times \frac{1\text{ m}}{10^{2}\ \cancel{\text{cm}}} = 3.76 \times 10^{-1}\text{ m}$$

(f) $$54\ \mu\text{m} = 5.4 \times 10^{1}\ \cancel{\mu\text{m}} \times \frac{1\text{ m}}{10^{6}\ \cancel{\mu\text{m}}} = 5.4 \times 10^{-5}\text{ m}$$

(g) $$1\text{ Ts} = 1\ \cancel{\text{Ts}} \times \frac{10^{12}\text{ s}}{1\ \cancel{\text{Ts}}} = 1 \times 10^{12}\text{ s}$$

(h) $27\ \text{ps} = 2.7 \times 10^{1}\ \cancel{\text{ps}} \times \dfrac{1\ \text{s}}{10^{12}\ \cancel{\text{ps}}} = 2.7 \times 10^{-11}\ \text{s}$

(i) $0.15\ \text{mK} = 1.5 \times 10^{-1}\ \cancel{\text{mK}} \times \dfrac{1\ \text{K}}{1000\ \cancel{\text{mK}}} = 1.5 \times 10^{-4}\ \text{K}$